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*Supplement of*

## **Responses of soil water storage and crop water use efficiency to changing climatic conditions: a lysimeter-based space-for-time approach**

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10 **Table S1:** Basic soil texture information for soils from Bad Lauchstädt (BL), Sauerbach (Sb), Dedelow (Dd), and Selhausen (Se). Please note the soil monoliths from Dedelow have a varying soil depth to the clay illuviation horizon (Bt) and to the marly, illitic glacial till (C-horizon). The profile for Dedelow describes the soil profile from soil monolith Dd\_1.

Soil	Horizon	Upper depth	Lower depth	Sand	Silt	Clay
		m	m	%	%	%
BL	Ap	0	0.23	5	73	22
	Axh1	0.23	0.33	4	83	13
	Axh2	0.33	0.70	4	82	14
	C1	0.70	1.10	6	67	27
	C2	1.10	1.45	5	72	23
	C3	1.45	>1.50	65	16	19
Sb	Ap	0	0.26	13	62	25
	M1	0.26	0.75	15	70	15
	M2	0.75	1.04	11	74	15
	M3	1.04	1.5	6	75	19
Dd	Ap	0.00	0.30	54	31	15
	Al+Bt	0.30	0.42	51	34	15
	Bt	0.42	0.90	52	23	25
	elCcv	0.80	1.50	59	29	12
Se	Ap	0	0.23	15	68	17
	Al-Bv	0.23	0.68	15	63	22
	II-Btv	0.68	>1.50	17	61	22

**Table S2:** Average observed soil water flux at 1.5m soil depth of soils from Bad Lauchstädt (BL), Sauerbach (Sb), Dedelow (Dd), and Selhausen (Se) under a dry climate Bad Lauchstädt (BL) and wet climate Selhausen (Se).

Origin	Transfer	2011*	2012	2013	2014	2015	2016	2017	Average <sup>#</sup>
		mm	mm	mm	mm	mm	mm	mm	mm
BL-		-8	-91	-91	119	-16	-35	-53	-28
Sb	BL	17	-18	-97	93	-38	-32	-12	-17
Dd	BL	33	-78	-63	164	-34	-52	-44	-18
Se	BL	17	-19	-99	96	-27	-41	-19	-18
BL	Se	31	61	-57	206	7	94	-14	50
Sb	Se	19	28	-28	132	-8	177	46	58
Dd	Se	48	66	76	284	41	223	27	119
Se-		28	30	-5	142	20	68	40	49
* April-December; # 2012 – 2017									

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**Table S3:** Site management information on seasonal crop type, sowing and harvesting date, crop growth length N-fertilizer and number of fungicide applications at Bad Lauchstädt and Selhausen. Calcium ammonium nitrate (KAS) was mainly used as N-fertilizer. Except for 2013 in Selhausen, where ammonium sulphate nitrate (ASS) instead of KAS was used.

Crop	Bad Lauchstädt					Selhausen				
	Sowing YY/mm /dd	Harvest YY/mm /dd	Duration [days]	N-Fertilizer (KAS) kg N ha <sup>-1</sup>	Number of fungicide applications	Sowing YY/mm/ dd	Harvest YY/mm/dd	Duration [days]	N-Fertilizer (KAS) kg N ha <sup>-1</sup>	Number of fungicide applications
Pea	11/ 05/04	11/ 08/11	99		0	11/ 06/01	11/ 08/25	85		0
Winter Barley	11/ 09/30	12/ 07/12	278	145	3	11/ 10/14	12/ 07/10	270	50	§
Winter Canola	12/ 08/27	13/ 07/23	330	210	2	12/ 09/18	13/ 07/25	310	130 <sup>#</sup>	1
Oat	14/ 03/13	14/ 06/03	82	60	0	14/ 03/05	14/ 06/03	90	60	0
Winter Wheat	14/ 10/13	15/ 07/28	288	60	2	14/ 10/07	15/ 07/21	279	90	2
Winter Barley	15/ 09/ 22	16/ 06/30	282	100	3	15/ 10/07	16/ 07/08	275	80	2
Winter Rye	16/ 10/05	17/ 07/17	285	100	2	16/ 10/11	17/ 07/21	283	78	0

# ASS; § no data available

- 20 **Table S4:** Average and coefficient of variation (CV) of yield for soil from Bad Lauchstädt (BL), Dedelow (Dd), Sauerbach (Sb), Selhausen (Se) under dry (BL) and wet climate (Se). Origin describes the location, where the soil was taken from and the location where the soil was transferred to, where the soil was transferred to. The value in the brackets describes the variability of yield for each soil type (standard deviation from three replicates).

Test site		2011		2012		2013		2014	2015		2016		2017	
Origin	Transfer	Pea		Winter barley		Winter canola		Oat	Winter wheat		Winter barley		Winter rye	
		t ha <sup>-1</sup>	CV %	t ha <sup>-1</sup>	CV %	t ha <sup>-1</sup>	CV %	t ha <sup>-1</sup>	t ha <sup>-1</sup>	CV %	t ha <sup>-1</sup>	CV %	t ha <sup>-1</sup>	CV %
BL		2.20 (±0.44)	20	9.30 (±1.01)	11	7.01 (±1.60)	23	#	7.81 (±0.42)	5	8.46 (±0.23)	3	7.35 (±1.35)	18
Dd	BL	1.11 (±0.48)	43	8.79 (±0.71)	8	5.64 (±0.50)	9	#	5.90 (±0.26)	4	9.42 (±0.81)	9	7.74 (±0.97)	13
Sb	BL	2.44 (±0.92)	38	10.28 (±2.47)	24	4.65 (±0.61)	13	#	8.33 (±0.37)	4	11.36 (±0.46)	4	6.83 (±0.92)	13
Se	BL	0.99 (±0.17)	17	7.76 (±1.50)	19	5.07 (±0.82)	16	#	6.36 (±0.36)	6	8.42 (±0.66)	8	5.45 (±0.53)	10
BL	Se	1.87 (±0.45)	24	8.43 (±1.29)	15	1.32 (±0.80)	62	#	5.66 (±0.88)	16	5.14 (±0.05)	1	4.77 (±0.44)	9
Dd	Se	1.13 (±0.64)	57	4.02 (±2.31)	57	2.21 (±0.38)	17	#	4.73 (±0.83)	18	3.51 (±2.31)	1	4.77 (±0.44)	9
Sb	Se	1.90 (±0.22)	12	5.06 (±3.56)	70	3.66 (±1.03)	28	#	5.67 (±0.14)	2	5.01 (±2.02)	40	6.37 (±0.57)	9
Se-		2.10 (±0.53)	25	7.93 (±0.61)	8	3.94 (±3.05)	77	#	4.61 (±0.71)	15	3.49 (±0.51)	15	4.22 (±0.97)	23

# Crop was not harvested but biomass was cut and removed in June. Manually tilled so that soil was bare fallow during summer